

Changing Epidemiologic Aspects of Typhoid Fever in California

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SUMMARY

Typhoid fever in California is no longer a major public health problem. The previously high incidence of water- and milk-borne infections has been greatly reduced. Human carriers now are the source of most infections.

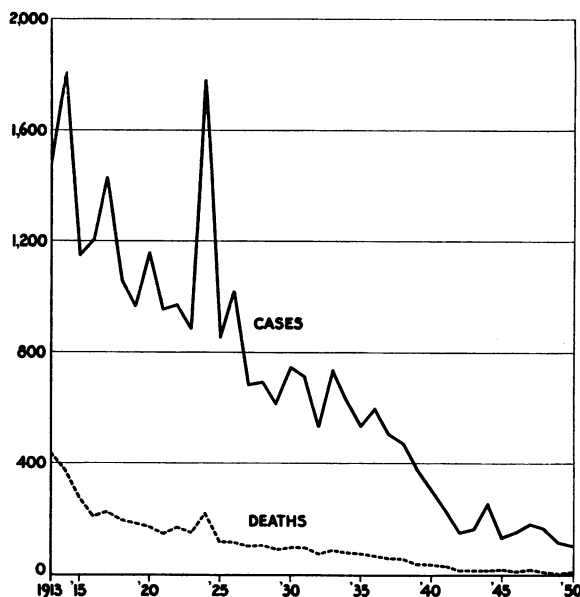
Chloramphenicol has proven to be a valuable aid in the therapy of the acutely ill patient, but it has not as yet solved the therapeutic or public health problems of typhoid fever. It continues to be vital for the protection of the public that every suspected case of typhoid fever be definitely established by appropriate public health laboratory procedures, that thorough investigation be carried out to determine the source of infection, and that careful follow-up examinations be done so that if a carrier state develops, proper measures can be taken.

EPIDEMIOLOGICALLY, typhoid fever in California has undergone almost as many changes as the scientific name of the causative agent. There has been a gradual shift from endemic prevalence with sizable outbreaks to sporadic cases or occasional small outbreaks. Water and milk have become of lesser importance as a source of infection and the individual carrier has become increasingly important. These evolutions have taken place over a period of years and reflect the progress made in sanitation, laboratory procedures, investigative techniques, and education.

Just what has happened in the incidence of typhoid fever in California since 1913 is traced in Chart 1. From a high of 1,805 cases with 436 deaths in 1914 there has been a steady decline except for the celebrated water and milk epidemic of Santa Ana in 1925. With this decreasing incidence, typhoid fever is becoming a medical curiosity and is seldom considered in the initial clinical examination of a febrile patient.

The only records available on the prevalence of this disease before 1913 appear in the comments

Chart 1.—Typhoid Fever, Reported Cases and Deaths—California, 1913-1950.



NOTE: 1919 DEATHS INCLUDE DEATHS FROM PARATYPHOID FEVER

made in the annual reports of the State Board of Health. These reports consistently note that the usual 500 deaths from typhoid fever occurred each year. It is interesting to note that these early reports constantly referred to the pollution of water by human excreta, the dangers of milk and the lack of public education in these matters. Yet as late as 1932 pollution of river waters continued to be a major source of typhoid fever.

Water-borne Typhoid Fever

The problem of river pollution started with the pioneers who preferred to establish settlements near a river or a stream. As the towns grew, the waterways gradually became the source of drinking water as well as repositories for sewage. As a result, the nearer the town was to the mouth of the river, the greater the chance for a polluted water supply.

In the delta region of the Sacramento and San Joaquin rivers there was excellent example of this effect on the incidence of typhoid fever. In the four-year period from 1924 to 1929, over 300 cases of typhoid fever originated in this area. In 1930 a program directed at improvement of the water supply, at camp and agricultural sanitation, and at immunization resulted in the virtual disappearance of typhoid fever from this region.

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Presented before the Section on Public Health at the 80th Annual Session of the California Medical Association, Los Angeles, May 13-16, 1952.

Water-borne outbreaks in urban areas have become rare if not extinct. The improvement of water supplies and sewage disposal systems leaves only the possibility of mechanical breakdown, accidental or intentional, to produce an outbreak from these sources in those areas.

Less progress has been made in the rural areas. Untreated water from polluted or potentially polluted streams is still being used for domestic purposes. Wells are not always properly constructed and frequently are situated with complete disregard of a nearby cesspool or privy. Small outbreaks from these sources are still occurring.

Milk-borne Typhoid Fever

Before pasteurization was accepted, before regulations requiring sterilization of utensils were adopted and before general control measures were instituted, milk was a major source of typhoid infections.

Several outbreaks resulting from contaminated milk are on record. Some were traced to a carrier working in a dairy, and some were traced to the simple fact that utensils were rinsed in a nearby ditch which served as a sewer outlet.

Such occurrences are no longer usual but the possibility still remains. Sixty-three cases of typhoid fever were reported from an urban area not so many years ago. The only common factor was a pasteurized milk supply. In investigation of the dairy plant, no defects in pasteurization were noted, but two employees were found to be carriers. One had little or no contact with the milk. The other worked on the bottling and capping machine. When the amount of pasteurized milk to be bottled and capped reached a low level this machine did not function. The carrier, therefore, manually filled and capped (and contaminated) the last six or seven bottles of each batch of pasteurized milk.

Dairy products or foods containing dairy products are more frequently implicated now than is milk itself, and outbreaks from such sources are usually traced to a carrier who worked in the preparation of such products.

Carriers

With the reduction in water-borne and milk-borne epidemics, the carrier has become the most important source of infection. Present-day outbreaks usually concern family groups or groups of persons with a common interest—the classic church supper, for example. Frequently the carrier is the cook, or a grandmother or, more recently, a relative who has been admitted to this country as a displaced person.

Tracing the infection to its source, to the carrier, has been made much easier and more accurate by phage typing. This test, which identifies the specific type of typhoid bacillus, is an invaluable aid to the investigator. A few months ago the State Department of Public Health received reports from three widely separated counties of six cases of typhoid fever, all caused by Phage Type C organisms. This coincidence, along with the dates of onset, indicated a possible common source. Investigation revealed that all of the patients had vacationed at the same resort

TABLE 1.—*Cases of Typhoid Fever with Known Source and Mode of Transmission for Selected Years*

	1920-1925		1940-1945	
	Cases	Per Cent	Cases	Per Cent
Water	713	60.0	13	7.0
Milk	464	39.0	8	5.0
Carrier	11	1.0	151	88.0
Total	1188		172	

where the water supply was from a well located alongside and downhill from the cesspool. A previously unknown carrier with Type C organisms had been at the resort at the same time as the persons who became ill, and had been having bouts of diarrhea at that time.

During another investigation of a series of cases all patients were found to have Type C infection, except one child who had Type E. In further investigation the grandparents of this child were found to be carriers of Type E organisms.

Discussion of Epidemiology

In Table 1, the great changes in epidemiologic factors since 1920 are noted. The years 1920 to 1925 were selected as being representative of the earlier years and 1940 to 1945 for the more recent years. Only those cases for which the source is known are included.

In California all known carriers are registered and certain restrictions are placed on them regarding food handling and hygienic habits. Of the total 589 carriers registered, 422 are now on the active list, the remaining 167 have died, have moved out of the state or have been released. This list represents only the known carriers. The major reservoir of endemic typhoid fever in California might well be persons who have had this disease and who are not aware of their carrier state, are not registered with their local health officer, and are not under supervision or treatment. This underlines the importance of careful follow-up of every known case, regardless of the mode of treatment, as noted below.

Chloramphenicol in Typhoid Fever

At this time, chloramphenicol is the only one of the newer therapeutic agents to show promise in the treatment of typhoid fever.¹³ Its effectiveness has not as yet been completely evaluated and the possibility that its use in the treatment of acute cases may increase the number of carriers has become a matter of interesting conjecture.

From a bacteriological point of view, chloramphenicol has not proven to be efficient. *S. typhosa* has been cultured from the blood and feces from several patients both while under treatment and following the discontinuance of therapy.^{2, 4, 6} Since the majority of cases appearing in the literature are reported at the time of clinical release, the bacteriological follow-up has not been sufficient to determine the effect of this drug in establishing the carrier state. Furthermore, attempts to cure the chronic carrier state have been for the most part unsuccessful.^{2, 11, 12}

From the clinical point of view chloramphenicol has not solved the therapy of typhoid fever. That it

gives symptomatic relief in acutely ill patients has been generally accepted.^{5, 8, 9, 13} Therapeutic response is not immediate. Alleviation of toxemia does not occur until 36 to 48 hours after the drug is given, and elimination of fever takes about four days under the present regimen of chloramphenicol therapy.^{1, 13} Relapses still occur and, indeed, there is some evidence that they may be more frequent.^{3, 4, 6, 7, 11} However, whether or not these effects are a matter of dosage, timing or adjuvant therapy remains to be settled.^{7, 9, 12, 13}

In view of the failure of chloramphenicol to completely prevent bacteriological and clinical relapses, the public health worker is concerned with the effect this drug may have on the carrier state. The evidence to support or reject this potential problem remains insufficient for firm conclusions. Douglas,³ Good and MacKenzie⁶ in England and Collins and Finland² in this country have noted the development of the carrier state in a few patients following chloramphenicol therapy. A series of cultures taken over a period of one year following recovery will be necessary before this question can be answered, and it is expected that the literature will be forthcoming from the many studies now in progress.

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